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GB 1455500
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GB 1422386
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GB 1035764
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(54) Magnetic cushioning and pressure applying means

(57) This invention relates to a novel cushioning and pressure applying means for compressing sheets of film in an X-ray cassette.

The cushioning means is provided by two sheets of rubber or plastics material each of which contains an array of magnets, the sheets being held together so that like magnetic poles are in opposition.

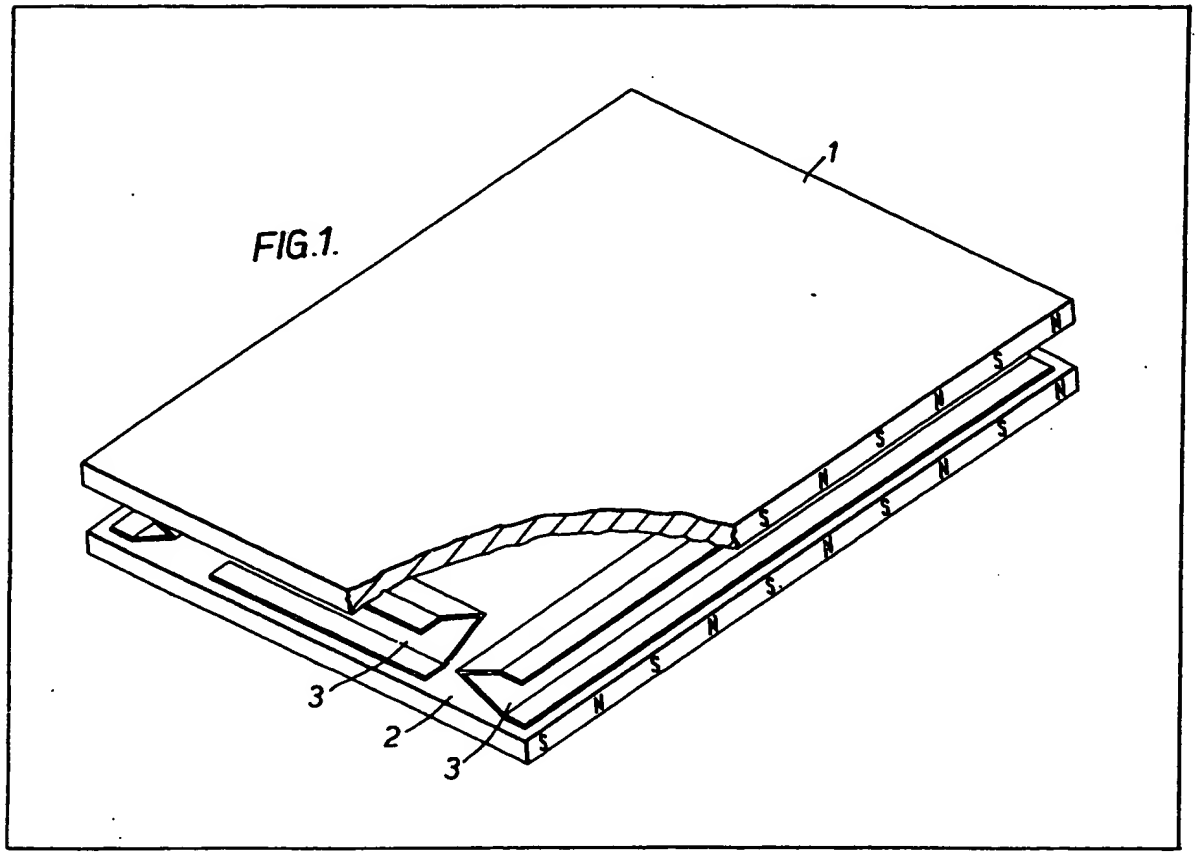

FIG.1.

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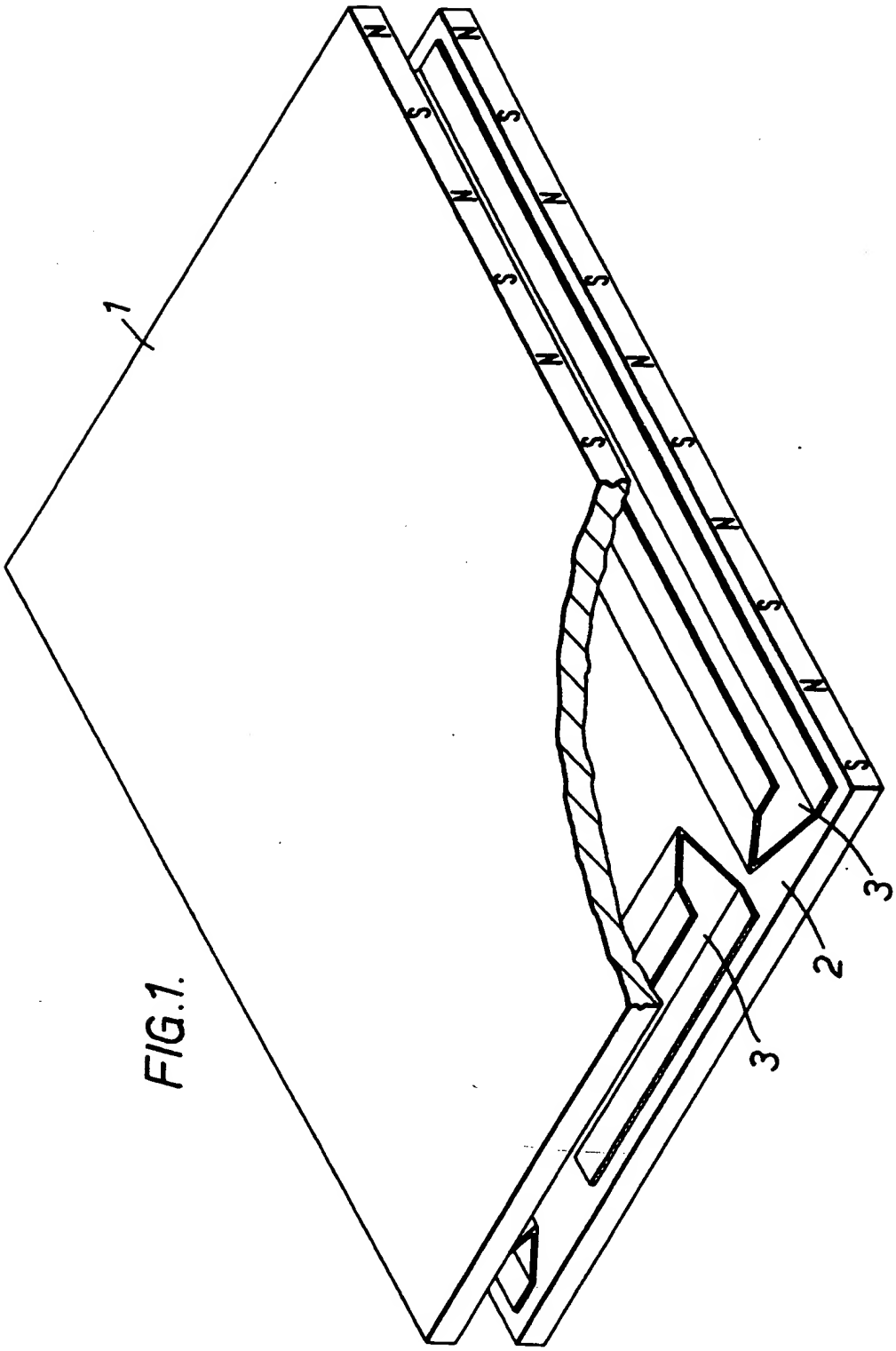

FIG.1.

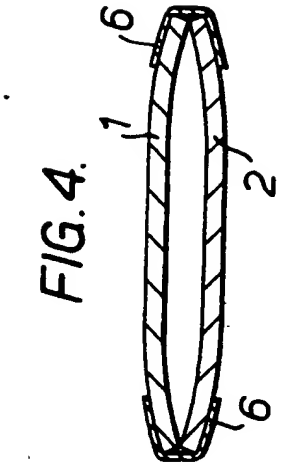

FIG.4.

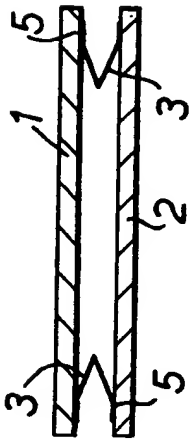

FIG.3.

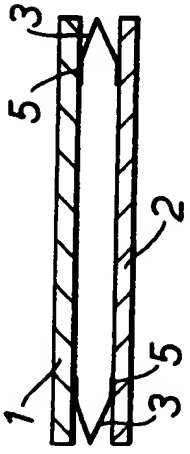

FIG.2.

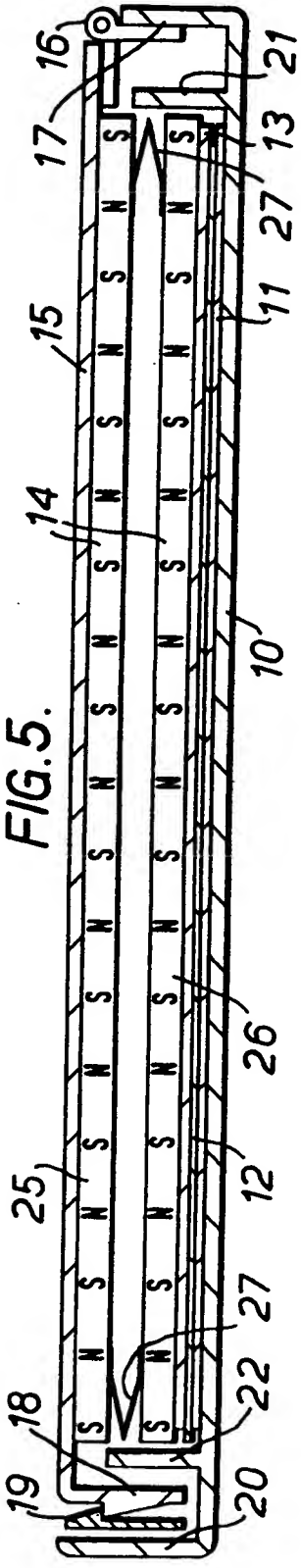

FIG.5.

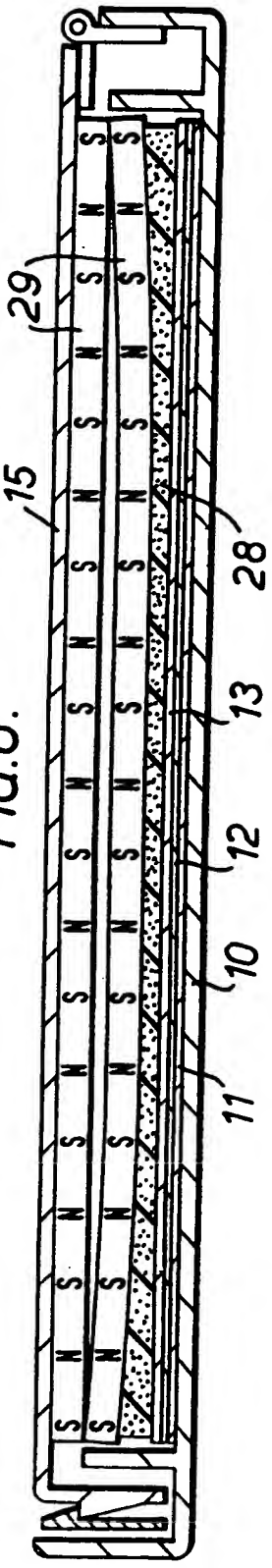

FIG.6.

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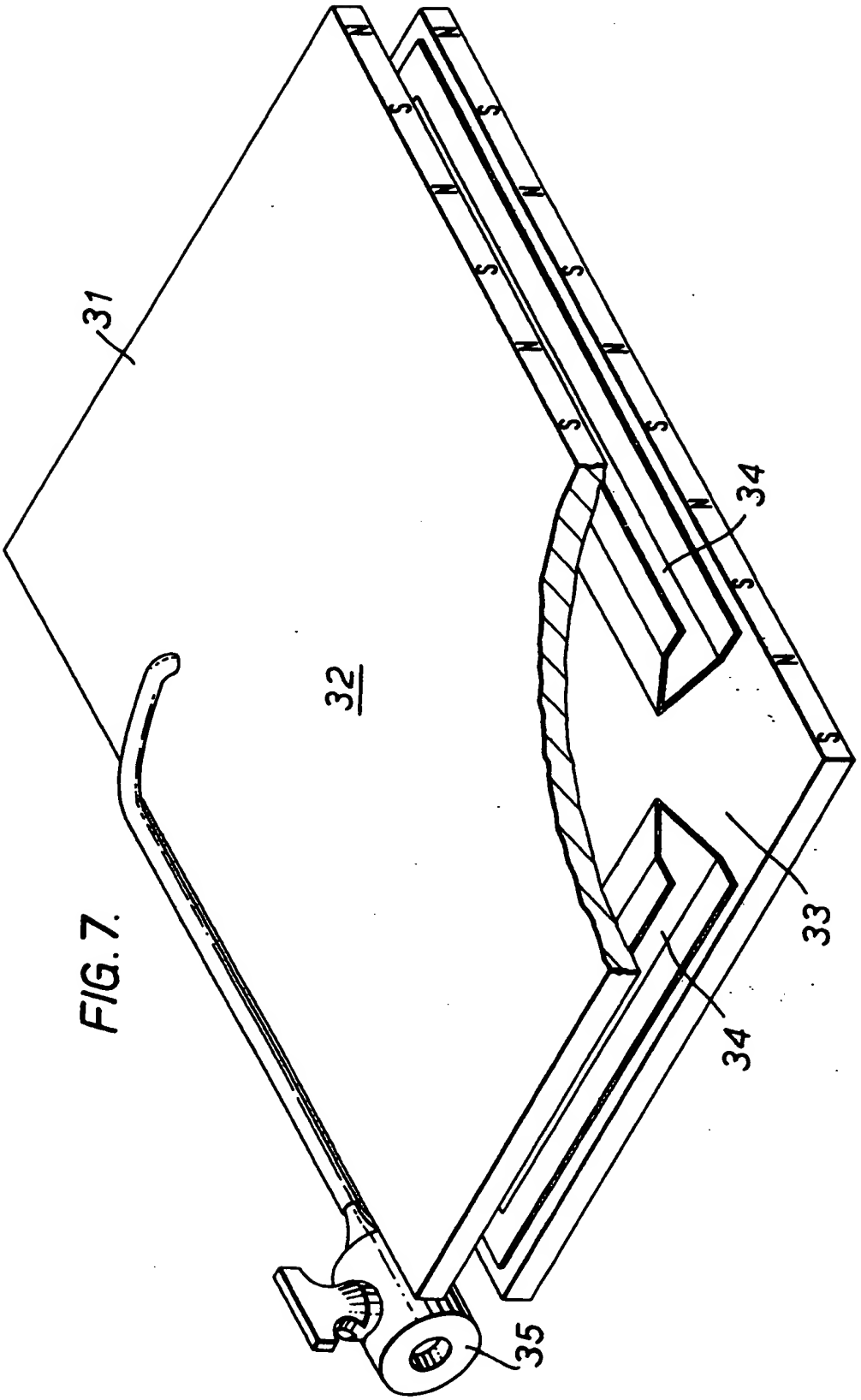

FIG. 7.

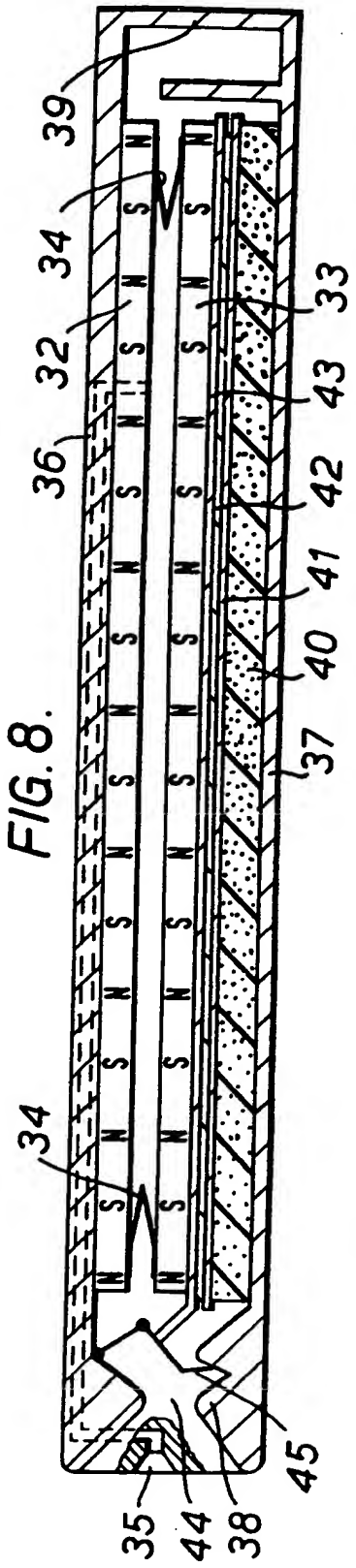
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FIG. 8.

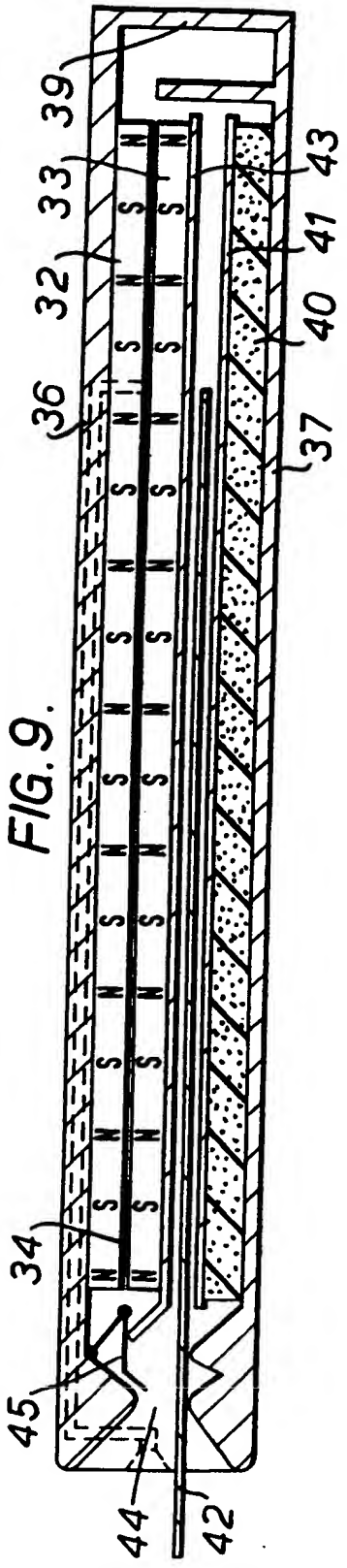
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FIG. 9.

SPECIFICATION

Novel cushioning and pressure applying means

This invention relates to novel cushioning and pressure applying means. Often it is required that two pieces of material, for example two sheets, are pressed together by resilient means. The usual material used to do this is a rubber or plastics foam material which is inserted between the two pieces of material which are required to be in contact and fixed non-resilient material which supplies the pressure and which is often the sides of a box or stiff inserts in a box. However often it is difficult to supply sufficient pressure or an even pressure using such a foam material. Fluid filled cushions have been tried but most rubber or plastics materials are not gas-tight and the pressure in the cushion quickly lessens as the gas escapes. The use of liquid filled cushions is usually to be avoided in case the cushion is punctured and the liquid escapes, causing damage.

We have invented a novel cushion which does not require an internal fluid for the cushion to retain its shape and resilience.

Therefore according to the present invention there is provided a resilient cushion which comprises two sheets of rubber or plastics material each of which contain integrally an array of magnets, the sheets being held together so that like magnetic poles are in opposition.

In one embodiment ventilation means are provided to allow air to circulate freely in the resilient cushion.

The cushion of this invention is hereinafter referred to as a magnetic sheet cushion.

Particularly suitable sheet material which contains integrally an array of magnets is the material known as magnetic rubber which is marketed by James Niell & Co., Sheffield.

In one useful form the sheet material has a series of north poles and south poles alternating across its width, this continuing up the whole length of the sheet. However the magnetic pattern may be of any type so long as it is possible to arrange for the two sheets having each an array of magnets to present like poles to each other.

Sheets of plastics material 0.5, 0.75 and 1.00 mm thick having arrays of magnets therein are also available.

The magnetic sheet cushion is of particular use in hinged X-ray film cassettes to ensure that the film sandwiched between two intensifying screens is subjected to even pressure over all its surface so that it is in close contact with both intensifying screens.

Most X-ray film cassettes consist of a flat rectangular thin box in which an X-ray film is sandwiched between two intensifying screens. The flat thin box usually consists of a front plate, through which the exposure to X-rays is made, attached to four side members which form a rectangle. To the bottom of this box is hinged a lid which forms the back plate when the lid is closed. Inside the box is an X-ray intensifying screen, a film (when the cassette is loaded), another intensifying screen and resilient means to press the two screens into close contact with the film. The film is removed by opening the hinged lid.

Often the resilient means is attached to the lid and frequently elaborate closing means are present in an attempt to obtain even pressure over the intensifying screen located next to the resilient means when the lid is closed. It is particularly important that an even pressure is applied to the film by the two intensifying screens and it has been found difficult to find a means whereby even pressure is exerted on the film at the edges and in the centre. Apart from elaborate lid fastening means other means designed to promote an even pressure include a cassette having initially curved front and back plates. However by use of the magnetic sheet cushion of the present invention it is possible to obtain such an even pressure over the whole of the film against the intensifying screen or screens.

The magnetic sheet cushion may be used in a hinged cassette to supply all the resilient pressure required for the sheet of film but there may also be present sheet foam material.

The magnetic sheet cushion will now be described with reference to its use in a hinged cassette but this cushion has many other uses in the fields of photography, packing and assembling equipment. Examples of such uses include contact printing in the graphic arts field where close contact between the dot screen and the film are required. The magnetic sheet cushion of the present invention is also of use as a shock absorber as the closer the two sheets are pushed together the greater the repulsion effect.

In another embodiment of the invention no ventilation means are provided and the cushion is completely air tight, valve means being provided to either suck the air out of the cushion or to refill it with air. In this embodiment when the cushion is full of air the cushion will be in the extended form due to the mutual repulsion of the two magnetic sheets. However when a vacuum is applied to the cushion the cushion will collapse, the two sheets approaching each other as the force of the vacuum overcomes the magnetic repulsion. When the vacuum is broken the magnetic repulsion force will take over again and the cushion will regain its original shape.

Such a cushion is hereinafter referred to as a sealed magnetic sheet cushion.

A sealed magnetic sheet cushion is of use when it is required that pressure applying means are used wherein the pressure can be relieved at will without having to remove the pressure applying means. The sealed magnetic cushion of the present invention is of use in an X-ray film cassette having fixed front and back plates. Such cassettes which are suitable for loading and unloading in daylight conditions consist of a frame to which is attached a substantially flat fixed front plate and a substantially flat fixed back plate and located therebetween a movable pressure plate for resiliently bearing towards the said back plate when the cassette is in the closed position. The

cassette also has at one end of the frame a slot for loading or unloading the cassette and a light shielding means which prevents ingress of light between the pressure plate and the back plate when the cassette is closed. Usually one intensifying screen is secured to the inside face of the back plate and the other intensifying screen is secured to the face of the pressure plate which faces the inside face of the back plate. In operation the X-ray film is sandwiched between the two screens, the pressure plate being biased towards the back plate. When the cassette is opened the pressure plate is lifted away from the back plate and this leaves sufficient room for the X-ray film to drop out of the cassette from between the two screens. Such a cassette is described in British Patent Specification No. 1361012 and another such cassette is described in United States Patent Specification No. 3930165.

X-ray film cassettes which comprise a frame to which is attached a substantially flat fixed front plate and a substantially flat fixed back plate and located therebetween a movable pressure plate for resiliently bearing towards the back plate when the cassette is in the closed state but which is raised from the back plate when the cassette is in the open state and which has at one end of the frame a slot for loading or unloading the cassette and a light shielding means which, when the cassette is in the closed state, prevents the ingress of light between the pressure plate and the back plate are hereinafter referred to as fixed plate cassettes of the type hereinbefore defined.

One of the troubles associated with fixed plate cassettes of the type hereinbefore defined is that it is difficult to provide an efficient pressure plate actuating mechanism in the small space available, the dimensions of the cassette being laid down by international standards and the maximum thickness of all the cassettes being 1.5 cm. The various pressure plate actuating means suggested tend to be mechanically unreliable and subject to mechanical failure. Also because of the low tolerances required both in the machining of the mechanical parts and in the assembly of the cassette the cassettes tend to be rather expensive.

The sealed magnetic sheet cushion of the present invention may be used to provide a simple and effective pressure plate actuating means. This use is shown in one of the accompanying drawings.

The accompanying figures will serve to illustrate the invention.

Figure 1 is a perspective cross-sectional view of a magnetic sheet cushion of the present invention.

Figure 2 is a cross-sectional view of the cushion of Figure 1.

Figures 3 and 4 are cross-sectional views of other cushions according to the present invention.

Figure 5 is a cross-sectional view of a hinged X-ray film cassette which contains the magnetic sheet cushion of Figure 1.

Figure 6 is a cross-sectional view of a hinged X-ray film cassette having a magnetic sheet cushion of Figure 4 in position together with a sheet of foam material.

Figure 7 is a sealed magnetic sheet cushion of the present invention.

Figure 8 is a fixed plate cassette of the type hereinbefore defined which contains the sealed magnetic sheet cushion of Figure 7.

Figure 9 is the fixed plate cassette of Figure 8 showing a vacuum being applied to the cushion.

In Figure 1 the magnetic sheet cushion comprises two sheets 1 and 2 of magnetic rubber jointed together by thin strips 3 of rubber which are joined to the two sheets by adhesive means. The number of strips 3 is sufficient to form a cushion from the two sheets and to enable air to circulate freely through the cushion. The disposition of two arrays of magnetic poles is indicated. There is very little stray magnetic field outside the back of the sheets. Each sheet is a magnetic rubber sheet 35 cm by 43 cm and 0.75 mm thick. The cushion is held apart by the repulsion forces of the two arrays of magnets but is kept as a cushion by the strips 3.

Figure 2 is a side view of the cushion of Figure 1 wherein the same numbers have the same signification showing the adhesive areas 5.

Figure 3 is a side view of another cushion showing the sheets 1 and 2 retained together by bent rubber strips 3 which are secured to the sheets by adhesive means at 5.

Figure 4 is a side view of another cushion wherein the edges of sheets 1 and 2 are secured together by adhesive tape means 6. This cushion assumes a bulbous shape as the repulsion effect cannot take place at the edges of the cushion.

Figure 5 shows a closed loaded hinged cassette which comprises a cushion as shown in Figures 1 and 2.

The cassette comprises fixed front plate 10, an intensifying screen 11, an X-ray film 12, an intensifying screen 13, a magnetic sheet cushion 14 and the hinged back plate 15. The hinge 16 is connected to the back plate 15 and one of the frame members 17 which is connected to the front plate 10. One end 18 of the back plate 15 is bent over to interlock with a latching member 19 which is located close to the opposite side frame member 20 to the member 17. Light shielding members 21 and 22 are also present in the cassette.

The cushion 14 comprises two magnetic rubber sheets 25 and 26 connected by foam rubber strips 27. The two sheets are kept apart by the repulsion forces exerted on each other by the like poles in the two sheets being in opposition. The disposition of these poles is indicated in Figure 5.

The presence of the cushion 14 between the closed and latched back plate 15 and the fixed front plate 10 ensures that the two screens 11 and 13 exert an equal pressure on the sandwiched X-ray film 12.

Figure 6 shows the same hinged cassette as that of Figure 5 but instead of the cushion 14 there is present a layer of foam rubber sheet 28 and a magnetic sheet cushion 29 as shown in Figure 4. Because this type of cushion cannot

expand at the perimeter under the influence of the magnetic repulsion, in this cushion the foam rubber sh t 28 has been curved upwards at its edges.

The effect of the cushion 29 and foam rubber sheet 28 is to exert a very even force on intensifying screen 13 to ensure that an even pressure is exerted on the X-ray film located between the intensifying screens 11 and 13.

In Figure 7 there is shown a sealed magnetic sheet cushion according to the present invention.

The cushion 31 comprises a top magnetic sheet 32 and a bottom magnetic sheet 33. Holding the two sheets together and making the cushion air-tight is a continuous sealing strip 34 made of rubber. In the figure strip 34 has been sectioned to show how it is fixed between the two sheets.

On sheet 32 is present a valve 35.

In Figure 8 a fixed plate cassette of the type hereinbefore defined is shown which comprises a fixed front plate 36 and a fixed back plate 37 and end walls 38 and 39. A slot 44 is shown in end wall 38.

Present, in order, in the cassette are a strip of foam material 40 which is secured to the inside of the back plate 37 and an X-ray intensifying screen 41. Above the screen 41 is an X-ray film 42 and above this a further X-ray intensifying screen 43. Then a sheet 33 which is a sheet of material which contains an integral array of magnets. This is the bottom sheet of the sealed magnetic sheet cushion 31 which is the cushion of Figure 7. The top sheet of this cushion is sheet 32. Strips 34 render the cushion air-tight. The valve 35 of the cushion is located at the entry end of the cassette. A light shielding device 45 is present in the cassette.

The arrangement of the poles on sheets 32 and 33 is indicated. The repulsive forces between the two sheets 32 and 33 cause the cushion 31 to be in the expanded stat .

In Figure 9 the same numbers have the sam signification. Figure 9 sh ws the cassette in the open state. A vacuum has been applied to the cushion 31 via valve 35. This has caused the cushion to collapse overcoming the repulsive forces of the two arrays of magnets on the sheets 32 and 33. Film 42 can now be removed from the cassette by gravity.

The magnetic sheet cushions illustrated in Figures 1 to 9 were composed of sheet rubber material.

Suitable plastics material for preparing magnetic sheet include copolymers of butadience and styrene, neoprene, isoprene and polyurethane.

CLAIMS

1. A resilient cushion which comprises two sheets of rubber or plastics material each of which contains integrally an array of magnets, the sheets being held together so that like magnetic poles are in opposition.

2. A resilient cushion according to claim 1 wherein the cushion comprises two rectangular sheets of rubber or plastics material held together by four lengthwise folded strips of plastics material.

3. A resilient cushion according to claim 1 wherein the cushion comprises two rectangular sheets of rubber or plastics material held together by a continuous strip of plastics material to form an air-tight cushion, together with valve means through which to remove air from the cushion or to refill the cushion with air.

4. A resilient cushion according to claim 1 substantially as hereinbefore described with reference to any one of Figures 1, 2, 3 or 7.

5. An X-ray film cassette which comprises a resilient cushion as claimed in any one of claims 1 to 4.

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